Soar Lint: Static Testing for Soar

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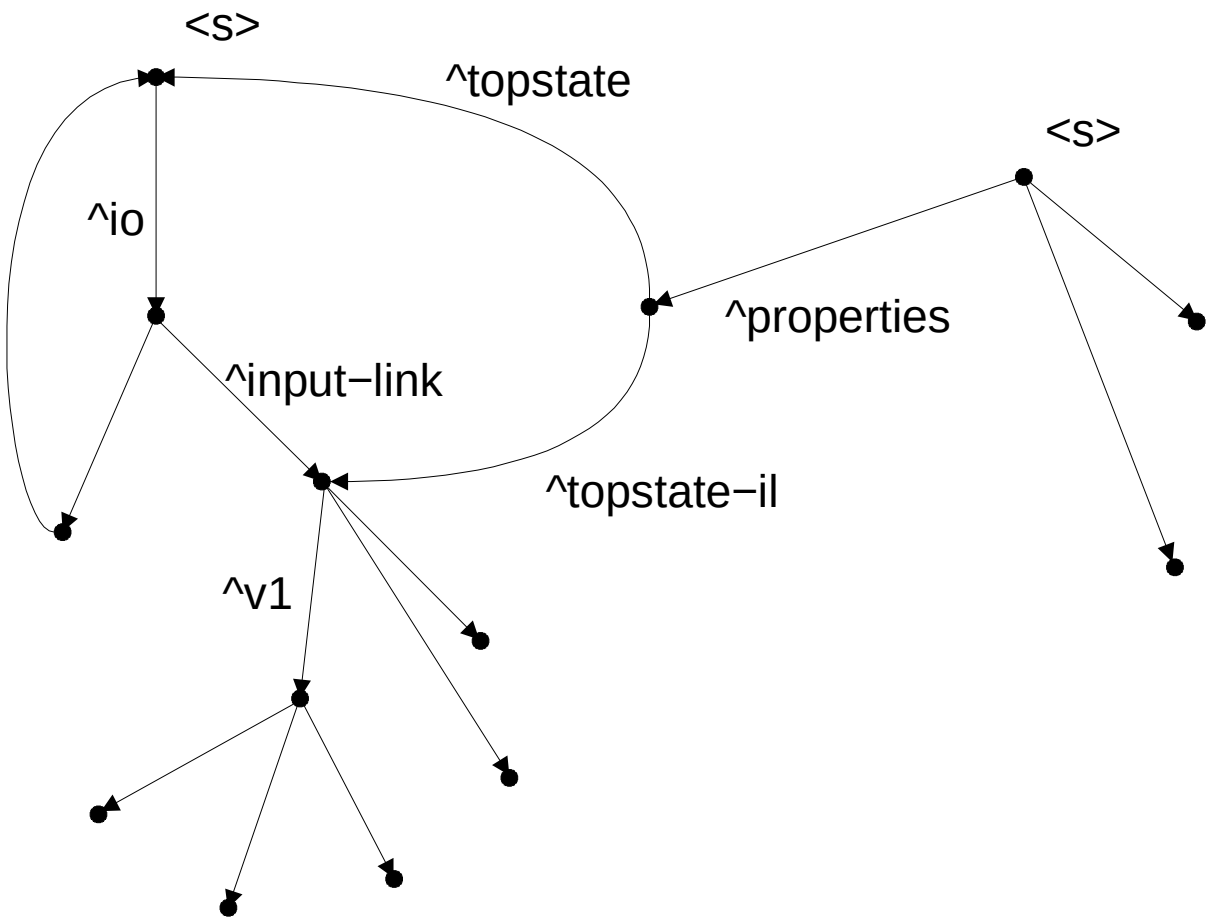
xxi Soar Workshop

The Datamap



Issues

- WME Consistency
  - Assume Datamap correct; can structure implied by productions be found in Datamap?
  - Assume productions correct; does implied structure cover everything in the Datamap?
- Operator Coverage
  - Is there an operator proposed at every point in the WM−state space?
  - Is there more then one operator proposed for some points?

WME Coverage

- First, test if all structure implied (generated or tested) by productions has corresponding structure in Datamap
- Then, compare structure generated to structure tested

WME Coverage

Tested? \ Generated?	**1**	**0**
1	OK	A production will never fire, because it tests something which is never generated
0	Structure is added uselessly, since it is never tested	DM thinks this structure should be here, but the productions have other opinions

Operator Tests

The Fundamental Question:

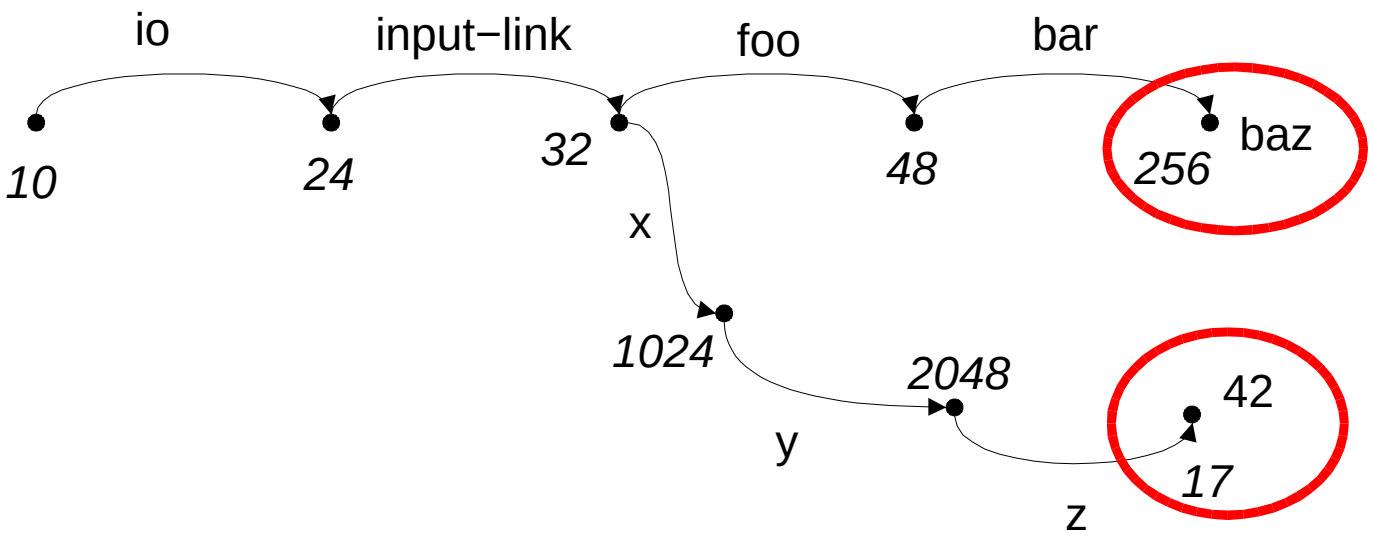
Are there regions of the WME−state space in which too many or too few operators will get proposed?

Operator Tests

- Find operator proposal rules in productions
  - mention an ^operator in RHS but not LHS
- Find their state−names
  - state−vertex is part of output of V−S parser; if it has a ^name augmentation, that's it, otherwise it's an all−production
- Gather productions by problem−space (all−productions separately)
- Run tests

Testing an Operator

```
(state <s> ^io.input-link <il>)
(<il> ^foo.bar baz)
(<il> ^x.y.z 42)
```

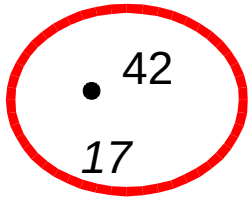


Only these two values are relevant!

Testing an Operator

```
(state <s> ^io.input-link <il>)
(<il> ^foo.bar baz)
(<il> ^x.y.z 42)
```

(node 256 == baz) &&
(node 17 == 42)



Operator Testing Analyzed

For op−props $\{x_i\}$, no operator will be proposed if:

$$\neg(\vee_i \{x_i\}) == \wedge_i(\neg \{x_i\})$$

Since each x_i is itself a conjunction, this is just the same thing as SAT

As long as there is not more than one negated condition in an x_i, it is also an instance of HORN−SAT

Soar Lint in the Real World

- WME Coverage
  - input−link and output−link had to be made special cases
  - negated conditions remain problematic
- Operator Coverage
  - it has proven useful to group operators by problem−space
  - necessary to find ways to reduce all possible LHS conditions to Horn form (!)
  - necessary to handle cases when two variables must have some relationship to each other, but actual values are never mentioned
  - existence tests must be fit into framework

Current Status

- WME tests just about ready for prime−time.
- Operator tests not as close, but since HORN−SAT has polynomial complexity in the number of variables, pursuing this thing seems likely to give good results.